



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

In Reply Refer To: 3AP20

JAN 11 2018

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Lou Ann Lee, Environmental Field Coordinator, Antero Resource
Antero Resources Corporation
535 White Oaks Blvd
Bridgeport, WV 26330

Dear Mr. Schatz:

Enclosed is the Air Compliance Inspection Report for the United States Environmental Protection Agency's ("EPA") September 18-21, 2017 inspection of Antero Resources Corporation ("Antero") oil and natural gas production facilities, located in Tyler, Ritchie, and Doddridge Counties, WV. Please take note of the Areas of Concern on page eight of the report. After you and your staff have reviewed the report, EPA would like to provide Antero the opportunity to discuss the Areas of Concern identified and Antero's potential remedies. Specifically, EPA is interested in discussing the design and operation of the enclosed combustor controls at Antero facilities. In addition to the inspection report, a compliance alert issued to industry by EPA in September 2015 is included that addresses some general compliance concerns regarding emissions from storage vessels at oil and natural gas production facilities.

If you have questions or comments, or would like to schedule a meeting, please contact Mr. James Adamiec of the Air Protection Division at (215) 814-2175 or Mr. Doug Snyder of the Office of Regional Counsel at (215) 814-2692 within fifteen (15) days of receiving the inspection report.

Sincerely,

A handwritten signature in blue ink, appearing to read "Zelma Maldonado", is placed below the word "Sincerely,".

Zelma Maldonado, Associate Director
Office of Air Enforcement & Compliance Assistance

cc: Christopher Williams, USEPA Air Enforcement Division, Washington, D.C.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Inspection Date(s): 9/18/2017 – 9/21/2017

**Regulatory
Program(s):** SIP, NSPS

Company name: Antero Resources

Facility Name: Hamilton, Estlack, Weigle East, Eddy, Primm, Robert Williams, Fritz, Lockhart Heirs, Charlene, Walnut West, Diane Davis, Ness, John Richards, Edwin, Mackay, and Rock Run well pads

**Facility Physical
Locations:** West Union, Alma, Middlebourne, Pennsboro, and Pullman, West Virginia. See attachment 1 for details.

Mailing Address: 535 White Oaks Blvd, Bridgeport, WV 26330

County/Parish: Tyler, Ritchie and Doddridge

Facility Contact: Lou Ann Lee, Air Program Field Coordinator
lle@anteroresources.com, 304-842-4479

AFS Number: 54-1700078, et. Al. See attachment 1 for details.

NAICS: 211113 - Conventional Oil and Gas Extraction

SIC: 1311: Crude Petroleum and Natural Gas

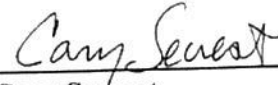
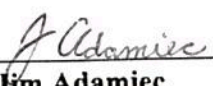
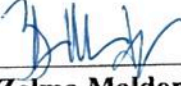
Attendees:

Facility Representatives:

Lou Ann Lee, Air Program Field Coordinator, 304-842-4479
Michael Gray, Production Maintenance Supervisor, 304-842-4920
Alicia Rafuse, Environmental Field Specialist II, 304-842-4055
Nick Summerfield, Environmental Field Tech, 304-842-4721
Chris Harman, Production Field Safety Supervisor, 304-677-0158
John Warren, Production Field Safety Supervisor, 724-988-6300
Randy Kloberdanz, Environmental and Regulatory Director

EPA Inspectors:

Cary Secrest, USEPA Headquarters, 202-564-8661
Jim Adamiec, USEPA Region III, 215-814-2175

EPA Lead Inspector		11-14-17
Signature/Date	Cary Secrest	Date
EPA Inspector		1-9-18
Signature/Date	Jim Adamiec	Date
Supervisor		1/11/18
Signature/Date	Zelma Maldonado	Date

I. Introduction

The United States Environmental Protection Agency (EPA) visited several Antero Resources (Antero) wellpads to verify compliance with permitting requirements and applicable State and Federal regulations. On September 12, 2017, the EPA notified Barry Schatz, of Antero, by phone and email that the CAA inspection would commence on September 18, 2017. In a later email, Antero notified EPA that Lou Ann Lee would be the point of contact.

A. Summary of the Facility-

EPA visited 16 wellpads owned, drilled and operated by Antero. The names of the sites are Hamilton, Estlack, Weigle East, Eddy, Primm, Robert Williams, Fritz, Lochart Heirs, Charlene, Walnut West, Diane Davis, Ness, John Richards, Edwin, Mackay, and Rock Run. The wellpads are located in Doddridge, Tyler, and Ritchie counties. These sites were chosen for inspection because they are the Antero sites which produce the largest amount of natural gas liquids; producing between 20,000 to 130,000 barrels of condensate per year. The wells located at the sites are horizontally drilled wells that have been hydraulically fractured to extract natural gas from the Marcellus Shale formation. The sites were drilled and completed after August 23, 2011 and are therefore subject to either NSPS OOOO or NSPS OOOOa (40 C.F.R. Part 60 Subpart OOOO – Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution for which Construction, Modification or Reconstruction Commenced After August 23, 2011 and on or Before September 18, 2015 or 40 C.F.R. Part 60 Subpart OOOOa – Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution for which Construction, Modification or Reconstruction Commenced After September 18, 2015).

All 16 visited sites are considered minor sources. Each site has either a minor source permit or a general permit G70 for natural gas production facilities (both under 45CSR13).

The general permit G70-C establishes the following maximum annual emission limits:

Inspection Date(s): 09/18/2017

Pollutant	Maximum Annual Emission Limit (tpy)
Nitrogen oxides	50
Carbon monoxide	80
Volatile organic compounds	80
Particulate matter	20
Sulfur Dioxide	20
Any single Hazardous air pollutant	8
Total Hazardous air pollutant	20

B. Inspection Opening Conference-

EPA met with Antero representatives at 9:00 am on September 18, 2017. Cary Secrest (EPA Headquarters), and Jim Adamiec (Region III) represented EPA. Present from the facility were Lou Ann Lee, Michael Gray, Alicia Rafuse, Nick Summerfield, and John Warren. The West Virginia Department of Environmental Protection was notified of the inspection; however, they were not able to attend. EPA presented their credentials and informed Antero that the purpose of the inspection was to assess compliance with the applicable regulations at the well pads. EPA informed Antero it would be taking photographs and videos with a digital camera and an optical gas imagining camera (FLIR GF320). Antero was informed of their right to claim any photo, video, or document as Confidential Business Information (CBI). Antero did not claim anything as CBI during the inspection. Following a safety briefing, EPA and Antero representatives drove together to the various well pads.

II. Process Overview

The 16 sites visited by EPA each have multiple horizontally drilled wells that produce natural gas, condensate and (produced) water. Each site has gas processing units, condensate storage tanks, produced water storage tanks, one or more enclosed combustors, and well heads. Some of the sites are equipped with vapor recovery units (VRU) and/or vapor recovery towers. Although Antero refers to them as VRUs these units do not recirculate any of the gas and instead function as a pump and compressor unit. The gas leaves the site via pipeline. The pipeline is equipped with a sale meter to record flow and a slug catcher to remove liquids.

As gas rises from the well it is a mixture of water, gas, and oil. The gas processing units (GPU) separate these materials into different components. The gas mixture enters the GPU and strikes a plate, causing some of the liquids to drop out as a water condensate mixture. Meanwhile, the gas rises and travels past the plate. The water/condensate mixture remains at the bottom of the drum. The condensate rises to the top of the water/condensate mix and overflows into a secondary tank where it is then routed to condensate storage tanks. The produced water is also sent to storage tanks. A VRU pulls the gas from the GPU and sends it to the pipeline for sale and transportation. Tank emissions from either working, breathing or flashing losses are routed to a header that is then routed to an enclosed combustor for destruction. The enclosed combustors only control emissions off the tanks.

At the majority of its wellpads, Antero uses Cimarron Energy, Inc. model ECD-3-48HV-90, natural draft enclosed combustors. If there are multiple enclosed combustors operating, flow from the tanks is routed evenly to each enclosed combustor through a header. Ms. Lee explained

Inspection Date(s): 09/18/2017

that the number of combustors used was determined based on initial production of each well. Operating parameters such as temperature and flame presence are monitored and stored in a central database.

Ms. Lee further explained that Antero uses a standard operating procedure in line with NSPS OOOOa (Standards of Performance for New Stationary Sources, Subpart OOOOa, Standards of Performance for Crude Oil and Natural Gas Facilities for Which Construction, Modification, or Reconstruction Commenced After September 18, 2015). Their procedure requires quarterly leak monitoring with an optical gas imaging camera.

III. Plant Tour / Walkthrough

At each site, EPA obtained photographs and recorded a FLIR video of the combustor(s) (see attachment 2: photolog). EPA also used the FLIR camera to observe tank hatches, wellheads, and GPUs at each site. On each operating enclosed combustor, a flame was observed through the sight glass, although at some wellpads the flame was pulsing. The pulsing could be described as the combustor flame having a fluctuating intensity; the flame would appear small before suddenly increasing and then dying back down again. Each increase in flame, or pulse, lasted only a second or two. As observed using the FLIR camera, uncombusted hydrocarbons were present at all but four of the enclosed combustors. EPA recorded FLIR videos of each enclosed combustor that appeared to have excess emissions.

Hamilton

Following the opening conference, EPA and facility representatives traveled together to the Hamilton wellpad (see attachment 1 for all wellpad addresses and coordinates), arriving at 10:08 am on September 18, 2017. Hamilton consisted of seven wellheads, seven GPUs, and seven storage tanks, plus two Cimarron enclosed combustors and one VRU. EPA observed the site using the FLIR camera and did not observe any excess emissions. The enclosed combustor plume, as viewed with the FLIR did not clearly show excess emissions. At 11:00 am EPA left Hamilton and proceeded to the next site.

Estlack

EPA arrived at the next site, Estlack wellpad, at 11:44 am. The site consisted of ten wells and GPUs, twelve tanks, three enclosed combustors, and five vapor recovery towers. The combustors appeared to show excess emissions when viewed with the FLIR camera. The combustors had the following characteristics:

Estlack Enclosed Combustors	
Unit ID	Operating Temperature (°F)
1378191	~250
1378189	~250
1378197	~250

At Estlack, EPA observed an emission from the GPU (MOV_0184) that appeared to be coming from an interior pneumatic controller. EPA also observed emissions (MOV_0185) coming from a VRU valve and regulator assembly. Antero maintenance personnel tightened the components and corrected the VRU emissions immediately. EPA departed the site and took a break for lunch at 12:58 pm.

Weigle East

EPA arrived at the Weigle East wellpad at 2:38 pm. This site contained three VRUs, six completed wells, eight wells under construction, thirteen GPUs, four enclosed combustors, and twelve storage tanks. EPA surveyed the equipment with the FLIR camera and found excess emissions at the enclosed combustor but no other equipment. The enclosed combustors had the following operating characteristics:

Weigle East Enclosed combustors	
Unit ID	Operating Temperature (°F)
1378143	269
1378144	262
1367703	152
1378118	195

EPA departed Weigle East at 3:43 pm.

Eddie

At 4:07 pm, EPA arrived at the Eddie wellpad. This pad has eight wellheads, eight GPUs, and eight tanks, plus one enclosed combustor, one VRU, and a lined, produced water lagoon. The lagoon stored water produced during the fracking. It was open to the air but covered with a net to keep birds out. EPA walked around the perimeter of the produced water pit and observed a slight hydrocarbon odor. EPA also used a photoionization detector around the perimeter and recorded <10ppb at all points. Using the FLIR camera, no excess emissions were detected from any tanks or other equipment at this site, however, the enclosed combustor, unit ID 1359740, appeared to have uncombusted emissions. The combustor was operating at 230°F. EPA left the Eddie wellpad and this concluded the inspections conducted on September 18, 2017.

Primm

The following day, September 19, 2017, the inspection resumed at 10:21 at the Primm Wellpad. This site has eight wells, eight storage tanks, and eight GPUs, and two enclosed combustors. EPA surveyed those components with the FLIR camera and found that there appeared to be excessive emissions from the enclosed combustors. Enclosed combustor ID numbers and operating temperatures are shown below:

Inspection Date(s): 09/18/2017

Primm Enclosed combustors	
Unit ID	Operating Temperature (°F)
1378133	373
1363528	195

EPA left Primm at 10:57 pm and proceeded to the next wellpad, Robert Williams.

Robert Williams

At Robert Williams, emissions were observed at the top of tank 009-00003982. The tank contained produced brine water and condensates. Antero representatives repaired the leak by tightening a hammer union; no emissions were detected afterwards. No other equipment emissions were identified at this site in either the wellheads or GPUs. The enclosed combustor at Robert Williams, unit ID 12363526, was pulsing and EPA noted it was operating at 84°F. FLIR video of the combustor appeared to show excessive emissions. EPA left the site at 11:52 am.

Fritz

At 11:57 EPA arrived at the Fritz wellpad. Fritz consisted of eight wellheads, eight tanks, and eight GPUs, plus four enclosed combustors. FLIR video of the combustor appeared to show excessive emissions. No excess emissions were detected from any other equipment. The enclosed combustors were operating as follows:

Fritz Enclosed combustors	
Unit ID	Operating Temperature (°F)
1878165	350
1378153	376
1378101	296
1378160	159

EPA left Fritz at 12:24 pm.

Lockhart Heirs

EPA arrived at the Lockhart Heirs wellpad at 12:41 pm. Lockhart Heirs had two wells and GPUs, eight tanks, and one enclosed combustor. The enclosed combustor unit ID is 1359742 and it was observed to be pulsing and operating at 344°F. FLIR video of the combustor appeared to show excessive emissions. No excess emissions were detected at this site. EPA departed Lockhart Heirs at 1:07 pm.

Charlene

EPA arrived at the Charlene wellpad at 2:47 pm. Charlene has ten tanks, eight wells and eight GPUs, and three enclosed combustors, although one was not operating at the time of the inspection. The remaining two enclosed combustors had unit ID numbers of 1386204 and 1386205 and were operating at 476°F and 507°F and pulsing was observed through the sight glass of each enclosed combustor. FLIR video of the combustor appeared to show excessive

emissions while the GPUs, wellheads, and tanks appeared normal. EPA left the site at 3:22 pm and proceeded to the next wellpad.

Walnut West

EPA arrived at Walnut West at 3:33 pm. The site has four wellheads and GPUs, five tanks, and one enclosed combustor. Excess emissions were detected with the FLIR camera from the combustor. No other equipment at this site showed evidence of excess emissions. The enclosed combustor unit ID at Walnut West is 1359748 and the operating temperature was 206°F. EPA departed the site at 3:58 pm.

Diane Davis

EPA began to inspect the Diane Davis wellpad at 4:35 pm. The site contained five wells and GPUs plus six storage tanks and an enclosed combustor. The enclosed combustor unit ID at this site is 1363506 and it was operating at 204°F. FLIR video of the combustor appeared to show excessive emissions. At this site, no emissions were observed from any equipment except the flare. EPA concluded at this site at 5:00 pm and this marked the final inspection of September 19, 2017.

Ness

The following day, September 20, 2017 EPA met with facility representatives and traveled together to the Ness wellpad, arriving at 10:16 am. This wellpad contained five wellheads and GPUs, six storage tanks, and one enclosed combustor. The enclosed combustor unit ID is 1359736 with an operating temperature fluctuating between 278°F and 323°F. FLIR video of the combustor appeared to show excessive emissions. EPA timed a one-minute interval during which the enclosed combustor was pulsing approximately every five seconds. After that one-minute period, pulsing continued intermittently. EPA departed the site at 11:06 am.

John Richards

The next inspection began at 11:21 at John Richards wellpad. John Richards consisted of four wellheads, GPUs, and tanks, plus one enclosed combustor. No excess emissions were discovered with the FLIR camera in any process unit. The enclosed combustor unit ID was not recorded but it was operating at 545°F and appeared to be operating as designed. EPA left the site at 11:45 am.

Edwin

The next site was the Edwin wellpad. EPA arrived at 12:10 pm and noted the presence of nine wellheads and nine GPUS, eight tanks, and two enclosed combustors. The enclosed combustor unit IDs were 1378162 and 1378104 and were operating at 820°F and 846°F, both hotter than previously observed enclosed combustors. There were no excessive emissions observed with the FLIR and the combustor plume appeared smaller than it had at other sites. No other equipment showed signs of excess emissions at this site. EPA departed Edwin at 12:32 pm.

Mackay

The next wellpad was Mackay. EPA arrived at 2:29 pm and observed eight wells and GPUs, three vapor recovery units, three enclosed combustors, and twelve storage tanks. One area of

Inspection Date(s): 09/18/2017

emissions was discovered on a vapor recovery unit and it was pointed out to Antero personnel. Of the three enclosed combustors, only one was operating: unit ID 1386215 with a temperature of 693°F. Observing the enclosed combustor with the FLIR camera did not reveal excess emissions and instead appeared to show a normal plume. EPA concluded the inspection of Mackay at 3:09 pm.

Rock Run

EPA arrived at Rock Run wellpad, at 3:36 pm. Rock Run was unique from the other sites in that it utilized not just one Cimarron enclosed combustor but also two additional Comm enclosed combustors. These were the only Comm enclosed combustors observed during the multiday inspection. The Comm enclosed combustors did not have a unit ID or serial number visible or readily available but their operating temperatures were recorded as 153°F and 351°F. The Cimarron enclosed combustor unit ID was 1378173 and it was operating at 353°F. The Cimarron flare appeared to be emitting excess emissions when viewed with the FLIR camera. The inspection concluded at approximately 4:15 pm.

IV. Records Review

EPA did not complete a records review during the inspection, however Antero did provide a document that detailed enclosed combustor design control efficiency data. This record was reviewed and discussed during the closing conference. Antero also provided a document entitled "Leak Detection and Repair (LDAR) Protocol, Antero Resources Production and Midstream Operations, West Virginia and Ohio," and, "40 CFR Part 60, Subpart OOOOa Fugitive Emissions Monitoring Plan, Antero Resources Corporation, September 2016."

V. Closing Conference

The closeout meeting took place on the morning of September 21, 2017 in Bridgeport, WV. Present for this meeting was Cary Secrest (EPA) and Lou Ann Lee (Antero).

VI. Areas of Concern

During the closing conference, EPA noted that hydrocarbon plumes from enclosed combustors that were running at higher temperatures (~ 500°F– 700° F), as observed with the FLIR camera near the top of the stack, were smaller than those that were running at much lower temperatures. EPA indicated that the combustion efficiency of the enclosed combustors may need to be evaluated by Antero to ensure that they are operating as designed. EPA and Antero discussed the possibility that changes in liquid production over the life of the well could be a factor in enclosed combustor efficiency. Ms. Lee mentioned that she had already spoken with Mr. Barry Schatz of Antero's Denver, Colorado office, and that Antero is resolved to review the design and efficiency of all its 209 Cimarron enclosed combustors, and to contact Cimarron for advice.

EPA also noted that the inspection revealed one small excess emission at the Robert Williams wellpad storage tank that was repaired on site. Additional emissions from equipment was found on vapor recovery units at the Estlack and Mackay wellpads.

VII. List of Attachments

1. Table showing wellpad names, inspection dates, and locations
2. Photo Log and photos
3. Video Log
4. EPA Compliance Alert

ATTACHMENT 1: Table showing wellpad names, inspection dates, and locations

Antero Wellpads					
Wellpad Name	AFS Number	Inspection Date	Address	Coordinates	
Hamilton	54-1700078	9/18/2017	20 Knights Fork Rd, West Union, WV 26456	39.36772	-80.7437
Estlack	54-9500057	9/18/2017	2288 Purgatory Rd, Alma, WV 26320	39.41371	-80.8778
Weigle East	54-9500045	9/18/2017	441 Lemasters Rd, Middlebourne, WV 26149	39.4662	-80.8528
Eddy	54-8500030	9/18/2017	4728 Mountain Dr, Pennsboro, WV 26415	39.33392	-80.9201
Primm	54-1700091	9/19/2017	1313 Oxford Rd, West Union, WV 26456	39.24142	-80.8527
Robert Williams	54-1700099	9/19/2017	20 Cabin Run Rd, West Union, WV 26456	39.2377	-80.8627
Fritz	54-1700107	9/19/2017	201 Elliot Rd, West Union, WV 26456	39.23416	-80.8401
Lockhart Heirs	54-8500031	9/19/2017	94 Holbrook Rd, Pullman, WV 26421	39.191	-80.8904
Charlene	54-8500036	9/19/2017	60 Gnats Run, Pennsboro, WV 26415	39.29972	-80.9638
Walnut West	54-8500038	9/19/2017	1758 Beech Grove Rd, Pennsboro, WV 26415	39.31311	-80.9982
Diane Davis	54-1700103	9/19/2017	2899 Sam Cavins Rd, West Union, WV 26456	39.30396	-80.8229
Ness	54-8500032	9/20/2017	3237 Oxford Rd, Pullman, WV 26421	39.19539	-80.9012
John Richards	54-8500037	9/20/2017	5513 Lynn Camp Rd, Pennsboro, WV 26415	39.20545	-80.9196
Edwin	54-8500034	9/20/2017	2720 White Oak Rd, Pennsboro, WV 26415	39.23035	-80.903
Mackay	unassigned	9/20/2017	2177 Leeson Run, Pennsboro, WV 26415	39.23833	-80.8971
Rock Run	54-1700108	9/20/2017	794 Tunnel Hill Rd, West Union, WV 26456	39.30496	-80.8147

ATTACHMENT 2: Photo Log and Photos

DSC00523	Hamilton Entrance Sign
DSC00524	Hamilton Wells
DSC00525	Hamilton GPU
DSC00526	Hamilton VRU
DSC00527	Hamilton Sale Meters and Slug Catcher
DSC00528	Estlack Entrance Sign
DSC00529	Estlack Entrance Sign with Well Names
DSC00530	Estlack Storage Tanks and Vapor Recovery Tower
DSC00531	Estlack Flares
DSC00532	Estlack Flare ID Plate
DSC00533	Estlack Site Overview
DSC00534	Weigle East Entrance Sign
DSC00535	Weigle East Entrance Sign
DSC00536	Eddy Entrance Sign
DSC00537	Eddy Produced Water Pond
DSC00538	Primm Entrance Sign
DSC00539	Primm Flare and Vent Gas Inlet
DSC00540	Robert Williams Entrance Sign
DSC00541	Robert Williams Tank
DSC00542	Fritz Entrance Sign
DSC00543	Fritz Entrance Sign
DSC00544	Lockhart Heirs Entrance Sign
DSC00545	Charlene Entrance Sign
DSC00546	Charlene Entrance Sign
DSC00547	Walnut West Entrance Sign
DSC00548	Diane Davis Entrance Sign
DSC00549	Ness Entrance Sign
DSC00550	John Richards Entrance Sign
DSC00551	Edwin Entrance Sign
DSC00552	Mackay Entrance Sign
DSC00553	Mackay Entrance Sign
DSC00554	Rock Run Entrance Sign

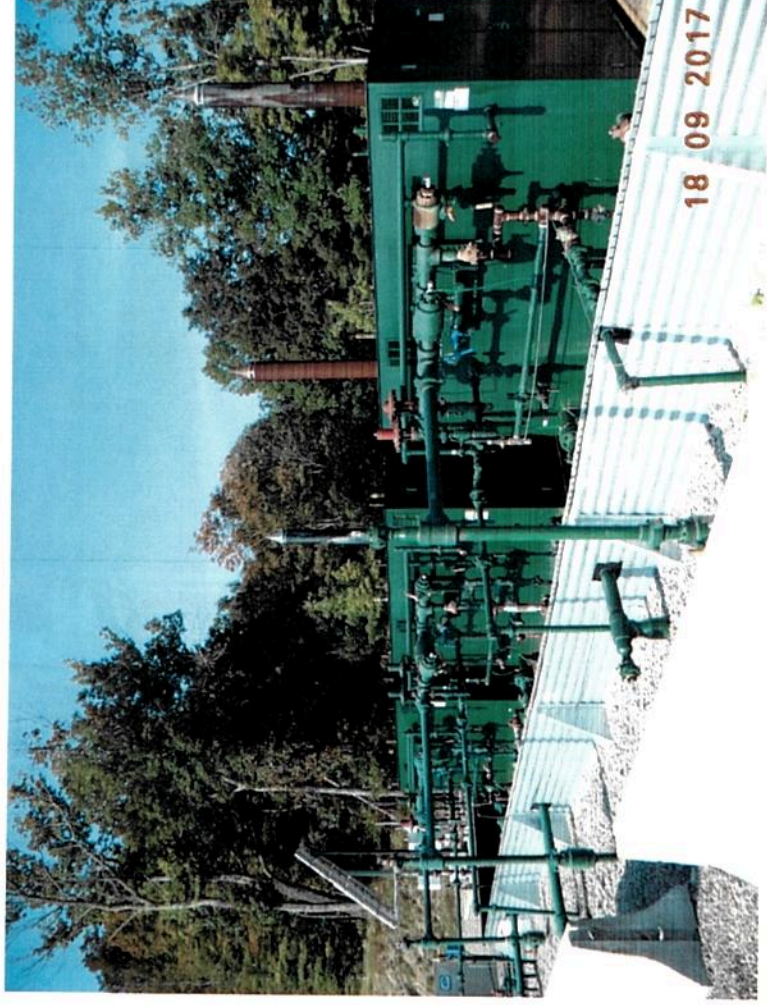
DSC00523 Hamilton Entrance Sign



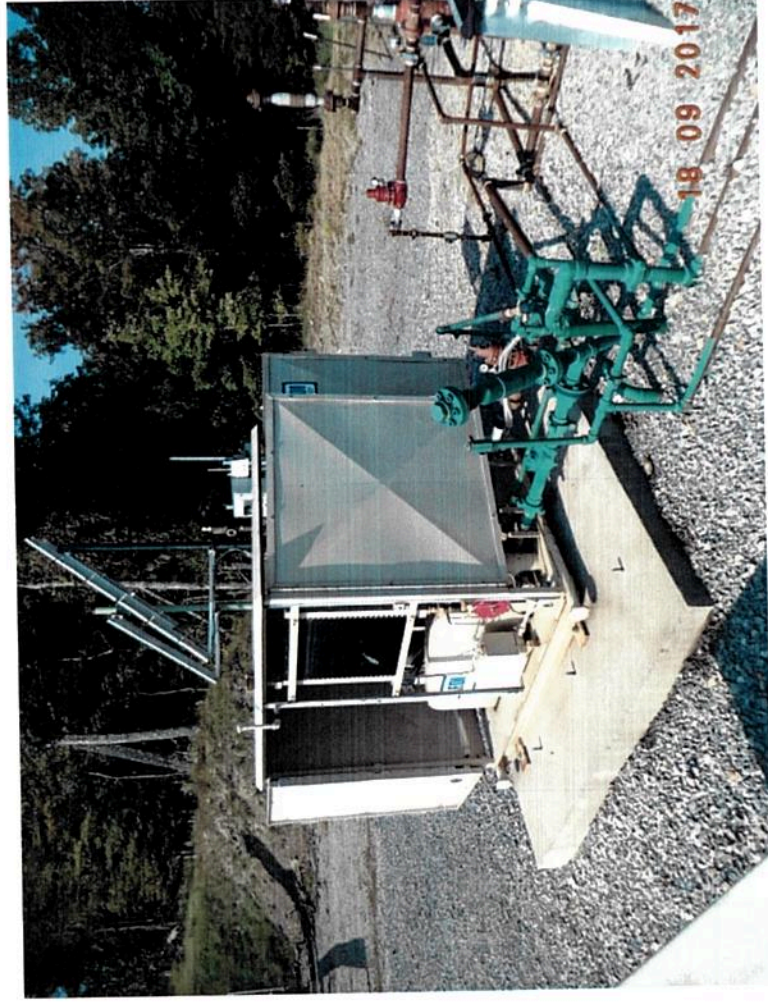
DSC00524 Hamilton Wells



DSC00525 Hamilton GPU



DSC00526 Hamilton VRU



DSC00527 Hamilton Sale Meters and Slug
Catcher



DSC00528 Estlack Entrance Sign



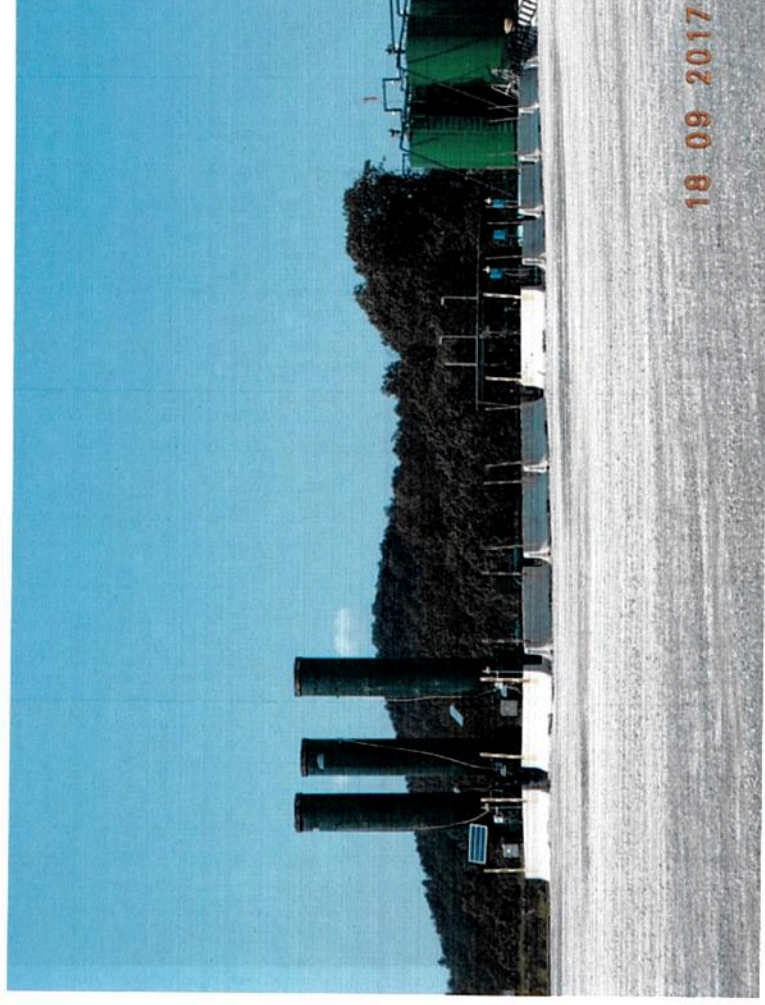
DSC00529 Estlack Entrance Sign with Well Names



DSC00530 Estlack Storage Tanks and Vapor
Recovery Tower



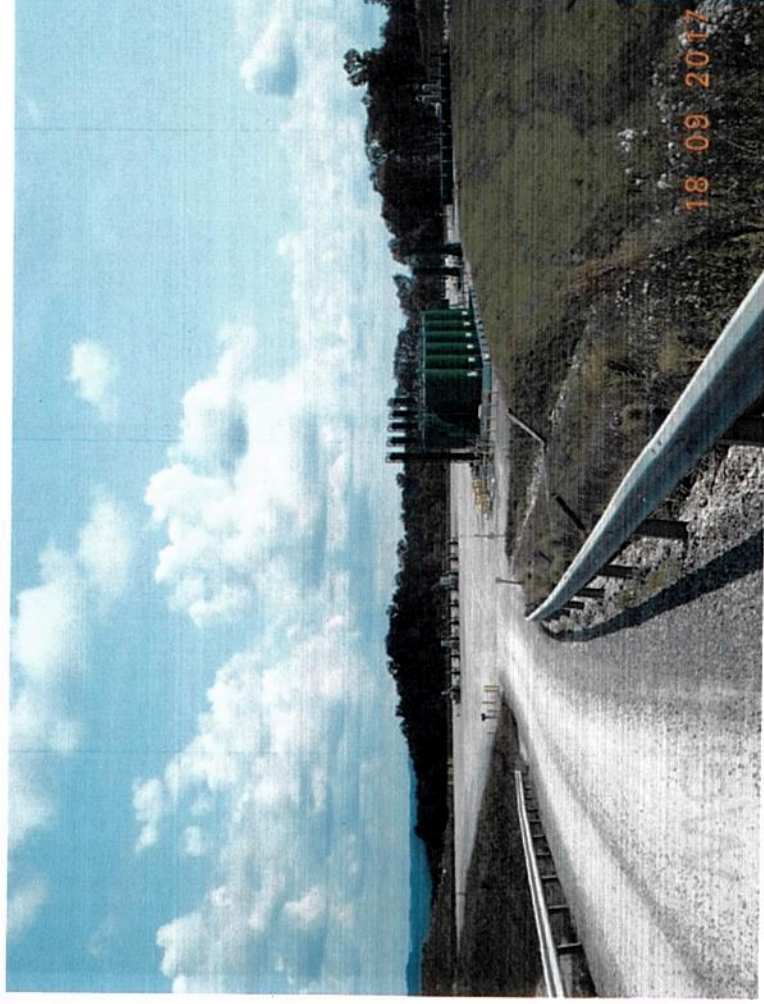
DSC00531 Estlack Flares



DSC00532 Estlack Flare ID Plate



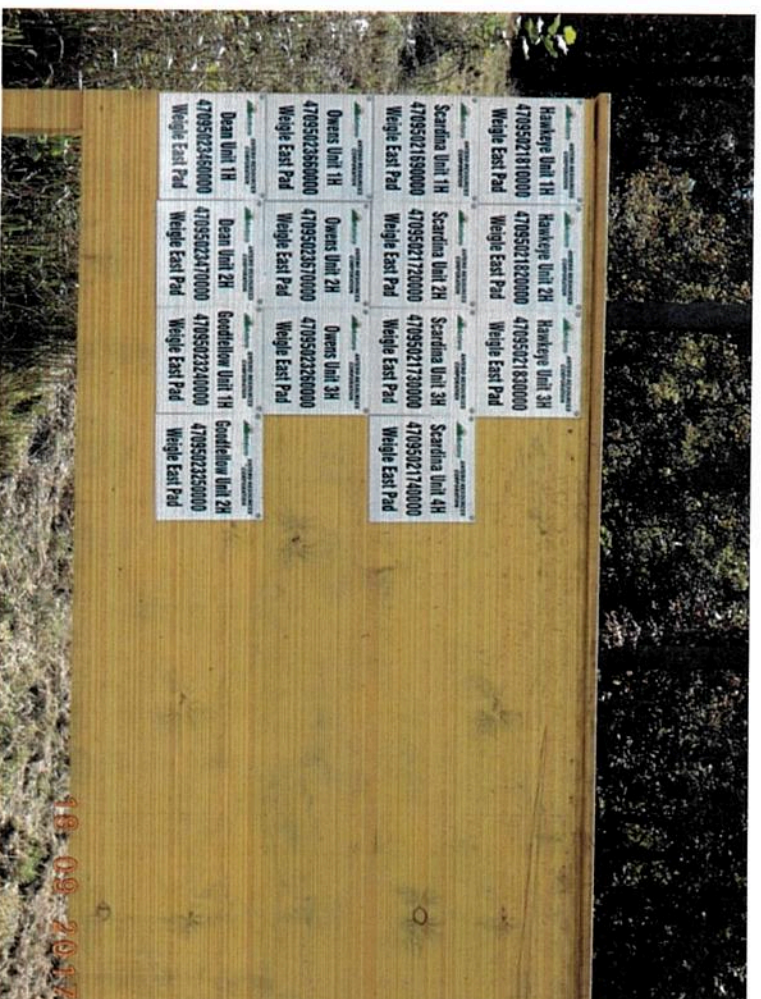
DSC00533 Estlack Site Overview



DSC00534 Weigle East Entrance Sign



DSC00535 Weigle East Entrance Sign



DSC00536 Eddy Entrance Sign



DSC00537 Eddy Produced Water Pond



DSC00538 Primm Entrance Sign



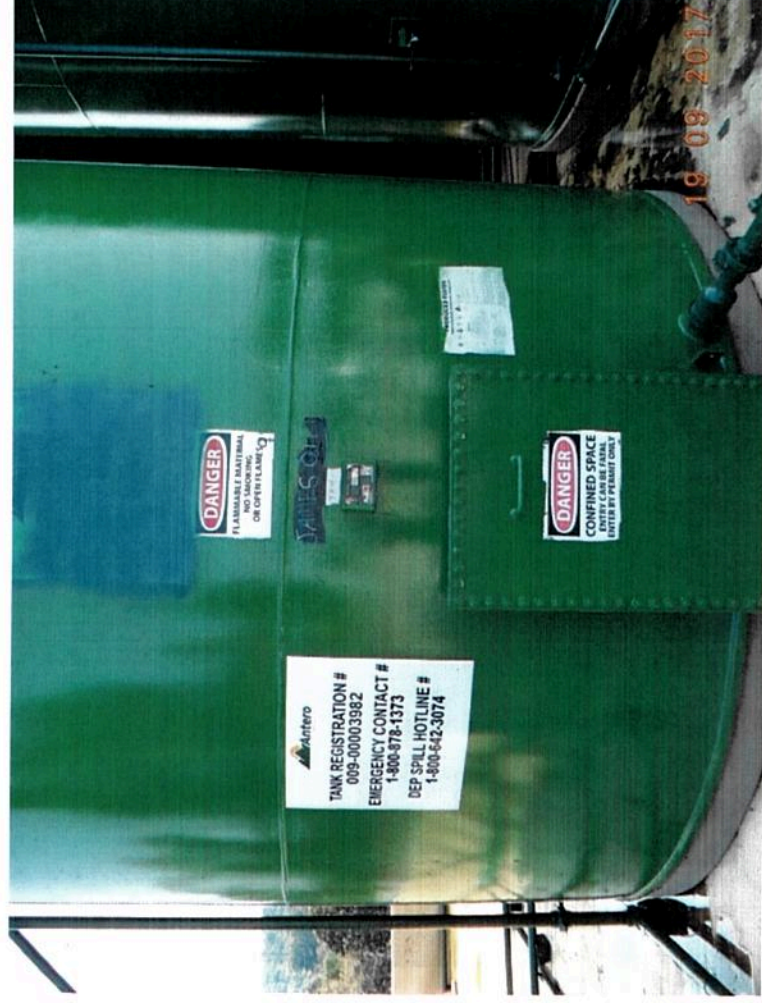
DSC00539 Primm Flare and Vent Gas Inlet



DSC00540 Robert Williams Entrance Sign



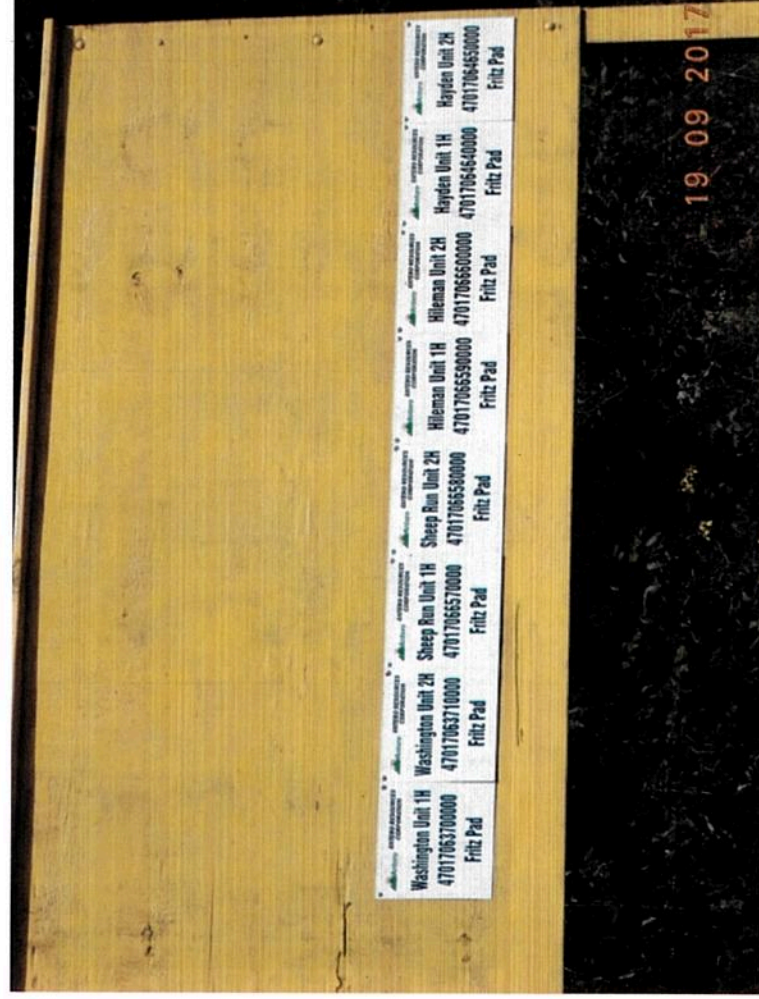
DSC00541 Robert Williams Tank



DSC00542 Fritz Entrance Sign



DSC00543 Fritz Entrance Sign



DSC00544 Lockhart Heirs Entrance Sign



DSC00545 Charlene Entrance Sign



DSC00546 Charlene Entrance Sign



DSC00547 Walnut West Entrance Sign



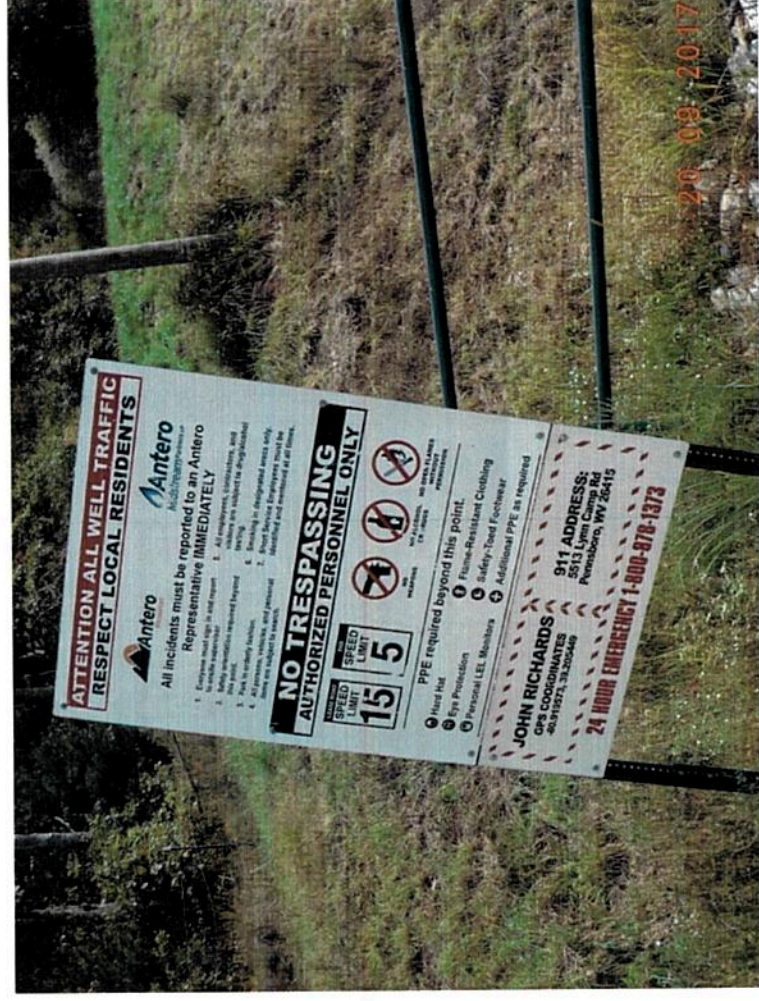
DSC00548 Diane Davis Entrance Sign



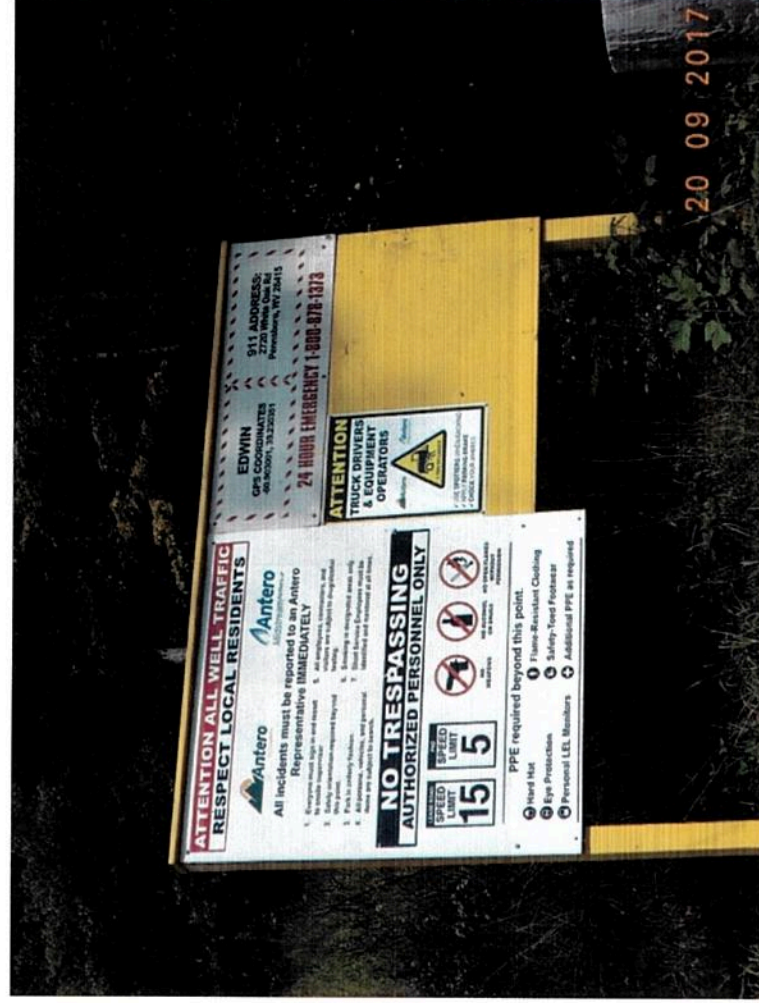
DSC00549 Ness Entrance Sign



DSC00550 John Richards Entrance Sign



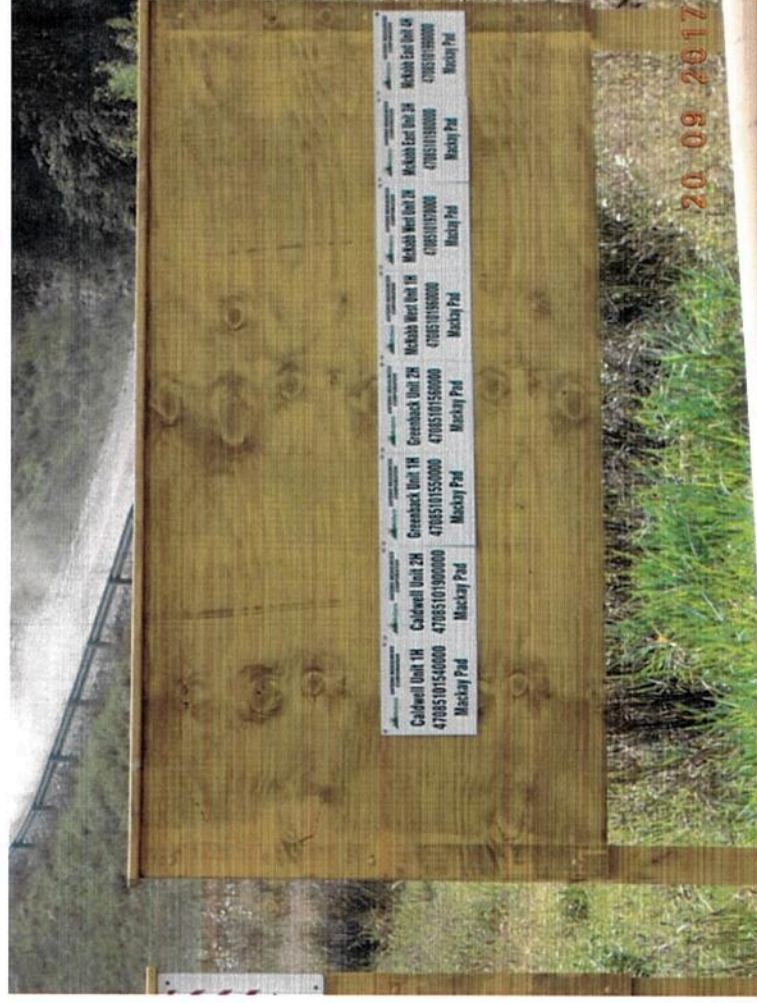
DSC00551 Edwin Entrance Sign



DSC00552 Mackay Entrance Sign



DSC00553 Mackay Entrance Sign



DSC00554 Rock Run Entrance Sign



ATTACHMENT 3: Video Log

MOV0181	Hamilton Flare
MOV0182	Estlack Flare
MOV0183	Estlack Flare
MOV0184	Estlack GPU Enclosure Vent
MOV0185	Estlack VRU Valve
MOV0188	Weigle East Flare
MOV0189	Eddy Flare
MOV0190	Eddy Flare
MOV0191	Primm Flare
MOV0192	Primm Flare
MOV0193	Robert Williams Tank
MOV0194	Robert Williams Flare
MOV0195	Robert Williams Flare
MOV0196	Fritz Flare
MOV0197	Lockhart Heirs Flare
MOV0198	Lockhart Heirs Flare
MOV0199	Charlene Flare
MOV0200	Charlene Flare
MOV0201	Walnut West Flare
MOV0202	Walnut West Flare
MOV0203	Diane Davis Flare
MOV0204	Diane Davies Flare
MOV0205	Ness Flare
MOV0206	Ness Flare
MOV0207	Ness Flare
MOV0208	Ness Flare
MOV0209	John Richards Flare
MOV0210	Edwin Flare
MOV0211	Mackay Flare
MOV0212	Rock Run Flare

Compliance Alert

September 2015

EPA Observes Air Emissions from Controlled Storage Vessels at Onshore Oil and Natural Gas Production Facilities

Purpose

The U.S. Environmental Protection Agency (EPA) is publishing this Compliance Alert because EPA and state investigations have identified Clean Air Act compliance concerns regarding significant emissions from storage vessels, such as tanks or containers, at onshore oil and natural gas production facilities. The Alert discusses certain engineering and maintenance practices causing the compliance concerns and potential emissions-reducing solutions. While this Alert provides information intended to help operators and state regulators identify and address compliance concerns, the Alert's engineering and maintenance practices do not equate to or guarantee compliance with federal and state regulations.

Compliance Concerns

This Alert aims to help operators assess whether their vapor control systems are properly designed, sized, operated, and maintained such that emissions from storage vessels may be controlled in compliance with applicable federal and state regulations. For purposes of this Alert, a "vapor control system" includes a closed-top storage vessel, all vent lines leading from the storage vessel, fittings and connectors in the vent lines, any liquid knock-out vessels in the vent lines, any pressure relief devices (PRDs) on the vessel or vent lines, and the control device used to combust gas or route gas into the sales line.

At onshore oil and natural gas production facilities, oil

and natural gas is extracted from sub-surface formations through a wellhead and then flows into a separator at varying pressures. The separator divides material from the wellhead into various constituents, such as oil, water, hydrocarbon liquids and natural gas or comingled



Storage vessels at an oil and gas production facility.

liquids and natural gas, depending on the characteristics of the well. The separator has a valve that opens to "dump" the pressurized liquid into a storage vessel.

While some storage vessels are designed to operate at

pressures greater than atmospheric pressure, most storage vessels currently used for oil and natural gas production are atmospheric storage vessels, which are only designed to operate at or below atmospheric pressure.

Storage vessel emissions at onshore oil and natural gas production facilities are regulated because they contain: (1) large quantities of volatile organic compounds

(VOCs) that contribute to the formation of ground-level ozone; (2) hazardous air pollutants (HAPs) such as ben-

EPA and state inspectors have observed emissions from storage vessel PRDs, such as closed thief hatches and pressure relief valves. Inadequately designed, sized, operated, and/or maintained vapor control systems may not effectively capture and control emissions.

zene, a known carcinogen; and (3) methane, a powerful greenhouse gas. Many storage vessels at onshore oil and natural gas production facilities generate emissions that can be safely and economically captured and controlled to protect public health and the environment, and prevent loss of valuable product. Moving from the high-pressure separator to a storage vessel's atmospheric pressure causes gas to "flash" off. In addition to flash emissions, storage vessels also have working emissions caused by liquid level changes in the storage vessel during loading and unloading operations and breathing emissions caused by temperature fluctuations in the storage vessel. State and federal laws require certain facilities to design, install, operate, and maintain effective pollution control measures to minimize the emission of VOCs from storage vessels. Such laws include state permitting and air pollution regulations – many of which are federally-enforceable and collectively referred to as the State Implementation Plan or "SIP" – and the federal New Source Performance Standards for Crude Oil and Natural Gas Production, Transmission and Distribution (NSPS



Infrared video image showing emissions from a thief hatch on a storage vessel.

0000). NSPS 0000 requires that new, reconstructed, or modified storage vessels with the potential for VOC emissions of equal to or greater than six tons per year reduce VOC emissions by at least 95 percent. That reduction also reduces HAP and methane emissions. The three predominant types of control devices used to

comply with the 95 percent control requirement are: (1) enclosed combustion devices; (2) vapor recovery devices; and (3) flares.

EPA and state inspectors have observed numerous instances of detectable emissions from controlled oil and natural gas storage vessels. The primary reasons for these detectable emissions are: (1) inadequate design and sizing of vapor control systems; and (2) inadequate vapor control system operation and maintenance practices. With respect to design and sizing of vapor control systems, the instantaneous peak surge of flash emissions that occurs when pressurized liquid is "dumped" from the separator (or other upstream pressurized vessel) to the atmospheric storage vessel – a "dump event" – can overwhelm an inadequately designed or sized vapor control system and create back pressure that causes VOCs, HAPs, and methane to escape from PRDs (e.g., thief hatches and pressure relief valves (PRVs)). Although this peak surge of flash emissions may be short in duration, flash emissions constitute the majority of storage vessel emissions. Inadequate operation and maintenance practices can prevent a vapor control system from achieving its full control capacity or performance and lead to sustained emissions from storage vessels. Such emissions can be large quantities of flash emissions during dump events and working and breathing losses at all times. For example, vapor line capacity for emissions is reduced if condensed liquid is allowed to accumulate in vent lines. Further, inadequate operation and maintenance practices can also compromise vapor control system performance if emissions are able to circumvent routing to a control device altogether through open thief hatches or improperly seated PRDs. In any of these situations, the storage vessel may be emitting VOCs in excess of federal or state regulations. EPA and its state partners are monitoring these compliance issues.

Engineering Solutions and Maintenance Considerations

There are numerous engineering solutions and maintenance

Dump events can overwhelm inadequately designed or sized vapor control systems and create back pressure that causes emissions to escape from PRDs.

nance considerations available to address underperforming vapor control systems. This Compliance Alert highlights some options that operators are employing when attempting to address issues with vapor control system performance. This Alert does not present an exhaustive list nor rank the engineering solutions and maintenance considerations presented herein. As with all engineering solutions and maintenance considerations, factors such as safety, protecting public health and the environment, timing, cost, and site limitations should be considered along with applicable regulations.

Reduce Liquid Pressure Prior to Transferring the Liquid to Atmospheric Storage Vessels

Many operators have experience adding multiple stages of separation to reduce the pressure of the liquid in the last stage of separation prior to dumping the pressurized liquid into atmospheric storage vessels. All else being equal, a smaller pressure differential between the last stage of separation and the atmospheric storage vessel will result in less gas being flashed off the liquid during the dump event. Vapor recovery towers, surge bottles, or other comparable intermediate pressurized vessels immediately upstream of the atmospheric storage vessel provide an additional stage of separation. The additional pressure reduction provided by an additional separation stage decreases the change in pressure that will occur



Hydrocarbon staining under a PRV indicating storage vessel over-pressurization.

when liquid is transferred to the storage vessel and thereby reduces the amount of flash emissions. Reducing flash emissions will typically lower the potential peak flow rate of emissions that a vapor control system

needs to handle. This may allow an existing, under-sized vapor control system to remain in place by reducing the flow to a rate that the existing system can handle. This is also a good approach for construction of new systems since it may allow for installation of a smaller, less expensive vapor control system, and it allows additional gas to be routed for sale.

Increase Size of Piping Used for Vent Lines (and Capacity of the Control Device if Necessary)

Many vapor control systems are constructed using piping, and possibly control devices, that are too small to effectively handle instantaneous peak flow emissions. If operators observe emissions from PRDs on their storage vessels equipped with vapor control systems, they could

consider reconfiguring the vapor control system by installing larger diameter piping and eliminating potential bottlenecks from the piping (*e.g.*, excessive fittings or pipe length that reduces capacity, etc.). An increase in vent line capacity may result in higher flow rates of gas to the control device, so control device capacity should also

be evaluated to ensure that the control device is properly sized for the full range of gas flows. Vapor control systems, whether new or existing, should be designed and sized to handle what the engineering analyses (*e.g.*, modeling) predict to be the worst-case or highest possible peak flow during operating conditions, including dump events. This ensures the vapor control systems can handle the potential peak instantaneous flow of emissions without causing PRDs to open. The system operating pressure may change over the useful life of the well for various reasons, including changes in formation pressure or natural gas sales line pressure. Updated engineering analyses should be conducted as appropriate.

Prevent Liquid Collection in Vent Lines

Vapor control system performance may also be compromised if condensed liquids are allowed to collect in vent lines that route emissions to a control device. Con-

densified liquid accumulation reduces vapor control system capacity, thereby inhibiting the flow of emissions to the control device, creating backpressure, and triggering the opening of PRDs. Reducing or eliminating low points in the vapor control system's piping configuration and installing knock out drums, drip pots, or other low-point liquid collection systems may restore some vent line capacity without the expense of installing larger diameter piping. However, eliminating liquid collection in vent lines cannot alone prevent the opening of PRDs during normal operations if the unobstructed cross-sectional area of the existing vent lines does not provide sufficient capacity to handle the potential peak flow rate of emissions without building excessive backpressure.

Eliminate Any Unintentional Natural Gas Carry-Through

Unintentional natural gas carry-through to a storage vessel can increase the potential peak flow of emissions to a vapor control system. In certain instances, this will result in continuous vapor flow to a storage vessel (*i.e.*, not just during dump events) and create enough pressure to trigger the extended opening of PRDs. Natural gas can be unintentionally carried through to a storage vessel during a liquid dump event or through a dump valve that is stuck in the open position (*i.e.*, where a valve failed to properly reseal). If operators conclude that unintentional natural gas carry-through is overwhelming a vapor control system, steps should be taken to eliminate such carry-through with maintenance and design changes (*e.g.*, repair or replacement of a stuck dump valve, installation of a vortex eliminator, installation of an appropriately sized separator, or maintaining liquid levels in the separator above a certain level).

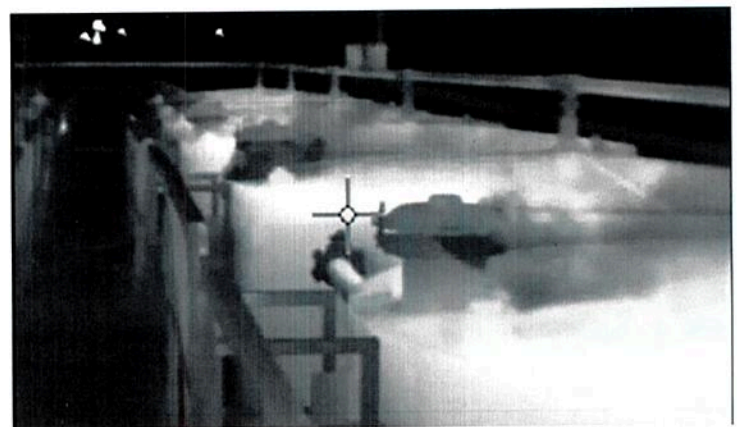
Pressure Relief Valves – Ensure Proper Maintenance and Set Points

PRVs function as safety devices to protect against structural damage that can result from over-pressurization and should not open during normal operations. A PRV should be selected, installed, and maintained to ensure proper functioning as an emergency relief valve to

maintain safe operation of the atmospheric storage vessel, rather than as a process vent during normal operations. The PRV's set point for opening must be set low enough to protect structural integrity and avoid over-pressurization of the storage vessel, but set high enough to exceed operating pressures experienced inside the storage vessel during normal operations, including flash emissions resulting from dump events. If an operator detects emissions from a PRV, steps should be taken to ensure that the valve has and will reseal properly after opening. Further, if PRVs are opening on a regular basis, the operator should determine the cause(s) and either: (1) increase the set point for the PRV if there is sufficient margin between the set point and the rated pressure of the storage vessel to do so safely and still protect storage vessel integrity; (2) take steps to decrease the operating pressures experienced at the storage vessel (*see above*); or (3) replace the storage vessel with a vessel that is rated to a higher pressure and then increase the set point for the PRV.

Minimize Emissions from Thief Hatches

To minimize emissions from closed thief hatches, operators should install quality thief hatch gaskets that are compatible with the liquids stored and regularly inspect,



Infrared video image of thief hatch emissions.

maintain, and replace the gaskets and all other contact points to ensure a tight seal. Similar to PRVs, thief hatches will open at a pressure set point. The set point should be set low enough to protect against storage vessel over-pressurization and high enough to avoid open-

ing during normal operations, including instances of flash emissions resulting from dump events. Operators should ensure that their liquid pumpers properly close thief hatches after vessel gauging and unloading.

Sampling and Modeling to Estimate the Potential Peak Flow of Emissions

A common approach to vapor control system design is to model the potential peak flow of emissions and size the vapor control system based on those results. Modeling inputs may rely on data from sampling of pressurized liquid obtained from the last stage of separation prior to an atmospheric storage vessel. Quality control procedures during sample collection and analysis are critical to obtaining reliable and accurate sample results. Care should be taken to prevent flashing of emissions during the sample collection procedure to ensure that the integrity of the composition of the pressurized liquid is maintained so that all material is included in the analyzed sample. Inaccurate sampling results could lead operators to underestimate the volume of flash emissions and, thus, under-design and under-size vapor control systems.

The California Air Resources Board (CARB) “Test Procedure – Flash Emissions of Greenhouse Gases and Other Compounds from Crude Oil and Natural Gas Separator and Tank Systems” is now being implemented and used by industry as a part of California’s mandatory reporting of greenhouse gas emissions. This “CARB Protocol” provides a narrative description of Gas Processors Association Standard 2174 with additional guidance on the maximum rate at which pressurized liquid samples should be pulled to minimize flashing during the sampling process. See <http://www.arb.ca.gov/cc/reporting/ghg-rep/regulation/mrr-2013-clean.pdf> (Appendix B).

Enforcement Settlement with Noble Energy

On April 22, 2015, the EPA, the Department of Justice,

and the State of Colorado announced a judicial settlement with Noble Energy that requires innovative solutions designed to evaluate and address VOC emissions from storage vessels due to under-sized vapor control systems and inadequate operation and maintenance practices. This settlement resulted from joint inspections conducted by the EPA and the State of Colorado, which found evidence of emissions coming from PRDs at

“The EPA is undertaking an enforcement initiative to ensure that natural gas extraction and production activities occur in a manner that protects communities from effects that may threaten health or the environment.”

-Cynthia Giles, Assistant Administrator of the EPA's Office of Enforcement and Compliance Assurance

many storage vessels. Subsequent data analyses indicated that many storage vessels were connected to vent lines with insufficient capacity to route all vapors to combustion devices without causing back pressure to build in the storage vessels and PRDs to open. The settlement provides an example of potential compliance issues that operators

may experience if vapor control systems are not properly sized, designed, operated, and maintained. Noble Energy is undertaking the following measures to help ensure compliance with federal and state regulations and reduce emissions:

- ⇒ Conducting engineering evaluations of vapor control systems (including revised emissions modeling), making necessary modifications to ensure the systems are properly-sized, conducting infrared camera inspections to ensure modifications are effective, and conducting a directed inspection and preventative maintenance program to ensure proper upkeep and operation;
- ⇒ Third-party audits of Noble Energy’s engineering evaluations and infrared camera inspections at a cross-section of vapor control systems;
- ⇒ Evaluating pressure relief devices and addressing evidence of emissions from those devices;
- ⇒ Installing pressure monitors on a cross-section of vapor control systems to verify storage vessels are not over-pressurized and potentially causing VOC emissions; and
- ⇒ Installing tank truck loadout control systems.

For more information, visit <http://www2.epa.gov/enforcement/noble-energy-inc-settlement>.

Conclusion

Responsible oil and natural gas exploration and production includes using good engineering practices to: (1) extract and route oil and natural gas to downstream operations for further processing; and (2) capture and route emissions to control devices. Inadequately designed, sized, operated, or maintained vapor control

systems can lead to increased emissions of VOCs, HAPs such as benzene, and methane. In some instances, such emissions violate federal or state regulations. In all instances, emissions from underperforming equipment erode public confidence, detract from an operator's social license to operate in that community, and potentially harm public health and the environment.



Potential Approaches for Improving Vapor Control System Performance

- ⇒ Use multiple stages of separation to operate with a smaller pressure differential between the last stage of separation and the atmospheric storage vessel to reduce flash emissions and the peak flow of emissions during dump events to the storage vessel.
- ⇒ Install vent piping with a diameter sufficient to handle the instantaneous peak flow of all potential emissions, including flash emissions during dump events.
- ⇒ Eliminate or reduce vent line low points and install drip pots or other low-point liquid collection systems as needed to avoid reductions to existing vent line capacity caused by liquid accumulation in vent lines.
- ⇒ If PRDs are opening on a regular basis due to storage vessel pressure, investigate whether unintentional natural gas carry-through could be occurring and take steps to eliminate it. If repeated PRD opening is not due to unintentional natural gas carry-through: (1) increase the PRD set points if there is sufficient margin between the set point and the rated pressure of the storage vessel to do so while continuing to safeguard storage vessel integrity; (2) take steps to decrease the operating pressures experienced at the storage vessel (see previous three approaches); or (3) replace the storage vessel with a storage vessel that is rated to a higher pressure and then increase the set points.
- ⇒ Install quality gaskets on thief hatches and regularly inspect those gaskets and all other contact points to ensure a tight seal, and ensure thief hatches are properly closed after vessel gauging and unloading.
- ⇒ Ensure that control devices are properly operated and sized to control the full range of gas flows that could be routed to them during different operational periods, including any increased flow rate that may result from retrofits to an existing vapor control system.

DISCLAIMER: This Alert puts EPA regulatory requirements in context with plain language. Nothing in this Alert revises or replaces any regulatory provisions, any other part of the Code of Federal Regulations, the Federal Register, or the Clean Air Act. Undertaking engineering or maintenance practices discussed in this document does not equate to or guarantee compliance with the Clean Air Act, its implementing regulations, and associated state and/or local requirements. For more information, visit: www2.epa.gov/compliance.